The Northwestern MILLER
MILLING PRODUCTION SECTION

Sack Silos

By Ernst Wolff

In modern milling plants stocks are handled automatically from the time they enter the grain intake hopper till the finished products are filled into bags. While operators are required to set and service the automatic equipment in the elevator, grain cleaning department and mill, it seems that if labor cost is to be significantly reduced, changes would have to be made in the handling of mill products from the bagging operation on until they reach the consumer. In the stages of storage and distribution, products are usually still handled by manually controlled methods.

Reports of a new process to economize greatly in the storage and handling of bagged products are now coming in from Europe. According to European practice, considerable quantities of flour are stored in mills in sacks, in addition to flour stored in bulk. When trucks arrive to pick up products, previously bagged flour is moved by operators to chutes or belts which convey the sacks to the trucks.

The traditional disadvantage of this method of loading is that where a loading crew sufficient for normal traffic is maintained, delays cannot be avoided whenever more than the usual number of trucks arrive at one time to be loaded. The ensuing waiting periods and bottlenecks hurt the mills' customer relations. If, on the other hand, a large enough delivering crew is maintained to handle such traffic peaks, many of these men will be idle for a considerable portion of their "working time."

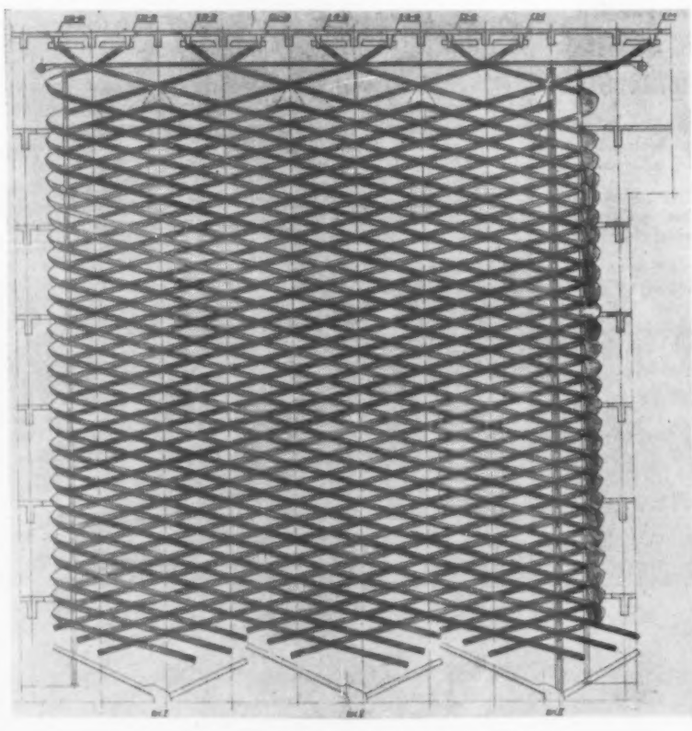
Another operation where the new development provides economies is night loading. Where loading operations must continue into the night in order to meet shipping dates or to accommodate customers, mills in Europe either employ their regular crew overtime or have a separate night shift. In many European plants packing capacity is sufficient to conduct bagging as a separate operation, independent from delivering, and to complete packing during the regular day shift working hours. But even then, when sacks are taken from warehouse stocks, a night delivery force is required. Due to overtime labor rates or differentials for night work, such loading outside the normal 40-hour week is expensive.

The new development simplifying loading operations and allowing them to be conducted automatically is termed "sack silo." Essentially, it is a system of slides, with electrically controlled gates and a number of counting devices. According to information received from Europe, the largest sack silo in operation has a capacity of 500 tons; the two most recent installations hold about 360 tons of bagged mill products each.

Almost all mills in Europe have long been equipped with sack slides on which sacks are conveyed from storage on upper stories to the loading platforms. Millers and milling engineers have almost equally long realized that these slides—which are usually spirally shaped to conserve floor space—could be used also for storage of filled bags.

In fact, mills at Livorno and Sampierdarena in Italy, both built before World War I, were provided with extra spiral sack slides for just that purpose. The Stucky mill in Venice, one of the largest and most modern of its time in Italy, was constructed in the twenties by Amme, Santi, Palma. In it the first specially designed sack silo of large capacity was incorporated. This installation is still in use, but the Stucky sack silo was no immediate success. Its cost was considerably more than that of a conventional warehouse. While it eliminated manual moving of sacks, all gates of the slides still had to be operated by hand. Only a further advance in electronic remote control was able to contribute enough additional features to warrant the higher original cost of sack silos.

The lower end of three slides. The rotary discharge valves and their electric drives are shown.



Arrangement of slides in the Auer mill sack silo.

Postwar Installations

The first installation featuring remote control was the Wessanen mill erected in 1930 at Wormerveer, Holland. Experience gained in this plant has been used in the design of the postwar installations. One of these plants is at the Auer mill in Cologne, Germany. The mechanical equipment of this plant was furnished by Buhler Bros.; Brown Boveri designed the electrical components. The other new plant is the Meneba mill, located in Rotterdam, Holland. It is equipped by MIAG and was scheduled to go into operation in the summer of 1953. We will use the Auer mill for a more detailed description of a sack silo installation. This plant has been in operation for a sufficiently long period to prove its worth; a full report on it was read by E. Auer at the German millers' convention in June, 1953.

The original plant of Auer was destroyed during the war. A new milling plant erected on the same site was completed in 1950. Planning of storage facilities for flour was preceded by a statistical analysis of the types of shipments. It was found that 93.55% of all outgoing prod-

(Continued on page 10a)

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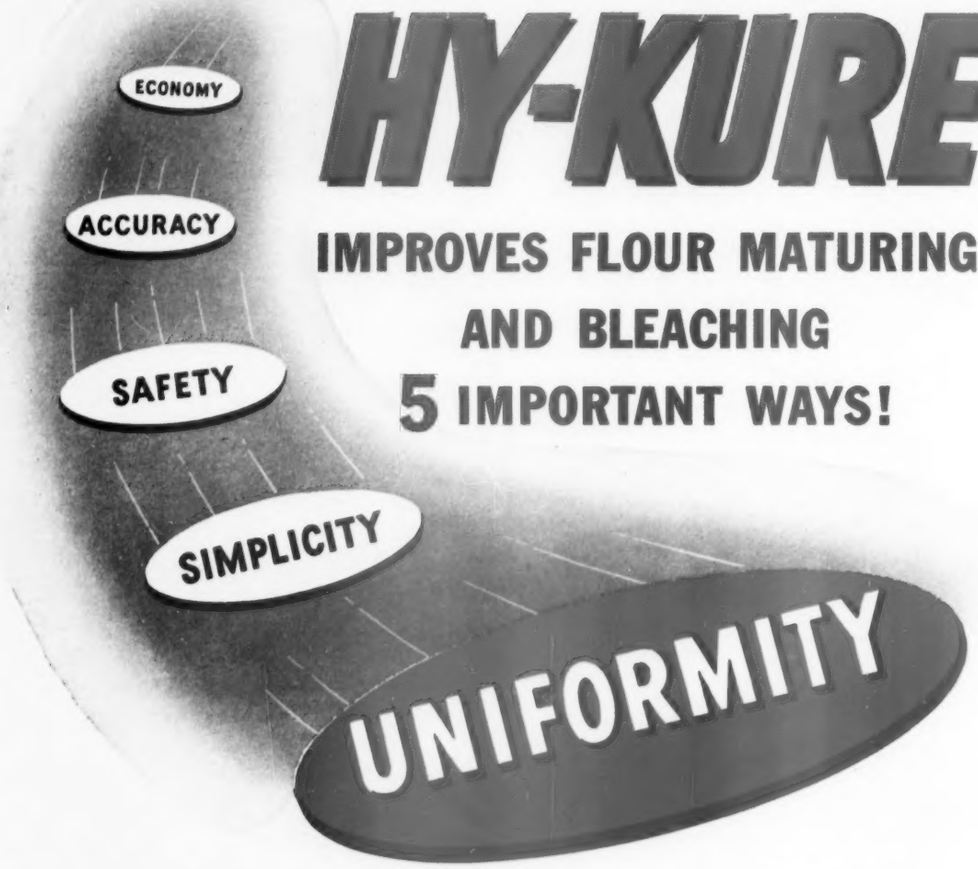

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A Scientific Problem:

How Does Material Flow From a Bin?

By John K. Rudd
Richardson Scale Co.

Forces governing the flow of solids in bins, chutes and hoppers may be accurately measured. And equations for solids flow may be drawn up. These equations would be analogues of the equations for liquid flow. Thus, a process engineer should eventually be able to design and specify bins, feeders or conveyors as precisely as he does tanks, pumps or fittings.

As a result of the past year's investigations on the nature of solids flow conducted at its materials-handling laboratory, Richardson Scale Co., Clifton, N.J., has also found that:

(1) There are fewer factors determining flow than was generally thought. The key ones are: (a) for the hopper: head, diameter, slope angle of sides and diameter of discharge opening; (b) for the material: coefficient of friction, ratio of lateral to vertical pressure, specific weight and shear strength. Temperature and moisture content may be indirectly accounted for or overlooked if the sample tested is representative of process material.

(2) To start flow of solids in a bin, you need only consider the forces acting on a central column of material extending up from the discharge opening.

(3) Material flowing from a confined area should be classified as either cohesive or noncohesive. Flow for the two classes is so different that it best be attacked as two different problems.

(4) There exists a minimum discharge opening for any given cohesive material in any given hopper or bin.

EDITOR'S NOTE: New findings made at the materials handling laboratory of the Richardson Scale Co., Clifton, N.J., are taking the guesswork out of bin design and putting solids flow on a scientific basis, according to Richardson engineers. This article is the first complete report on what's been accomplished. The author, John K. Rudd, is chief research engineer for the Richardson Scale Co. He received his B.S.E. from Princeton University in 1938 and his M.E. from the same university a year later. He has been with Richardson for the past five years.

How Findings Were Made

While finer knowledge of materials flow would help its engineers improve materials handling equipment, Richardson officials also believe a better understanding will enable the company to build faster and more accurate weighing equipment. So far, three investigations have been made and completed at the Richardson laboratory. They include:

(1) Measurements of pressure created by a head of material in straight and slope-sided hoppers. These tests were made primarily to check Jannssen's equation for pressure in circular, straight-sided hoppers, and to see how far the equation applied to slope-sided hoppers.

(2) Investigation of lateral and vertical pressures created by materials in different bin configurations. Lateral and vertical pressures under a given head of liquid, are always equal. This is not true for solids because of friction between adjacent particles of material and cohesion of particles.

(3) Investigation of the mechanics of flow. How do various materials behave when they flow from a bin? Are there any consistent patterns of flow? What effect has the geometry of the bin on discharge? What happens when material is removed from the bin while the bin is being fed? These are a few of the problems that we of the research staff tried to solve.

Little has been published in the field of solids flow. There have been some experiments conducted in soil mechanics; however, these studies are not generally applicable to investigation of solids flow in confined areas.

Pertinent research, though, was done by Jannssen and Airy. Both men have evolved equations for pressure exerted by material in straight-sided bins and hoppers.

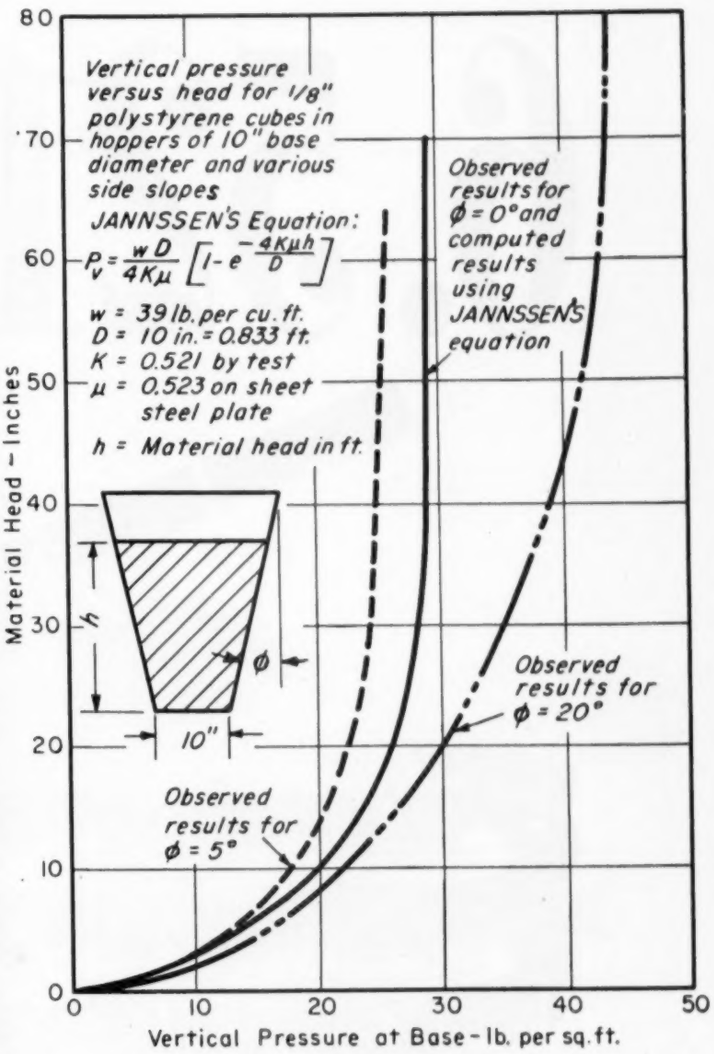
Vertical pressure versus head for 1/8" polystyrene cubes in hoppers of 10" base diameter and various side slopes
JANNSSEN'S Equation:
$P_v = \frac{wD}{4K\mu}\left[1 - e^{-\frac{4K\mu h}{D}}\right]$
w = 39 lb. per cu. ft.
D = 10 in. = 0.833 ft.
K = 0.521 by test
μ = 0.523 on sheet steel plate
h = Material head in ft.
Observed results for ϕ = 0° and computed results using JANNSSEN'S equation
Observed results for ϕ = 20°
Observed results for ϕ = 5°
h
ϕ
10"
Material Head - Inches
Vertical Pressure at Base - lb. per sq. ft.
0
10
20
30
40
50
60
70
80

Fig. 1—Curves show that Jannssen's equation for determining pressure on the discharge gate of a bin holds true for circular, straight-sided hoppers. An equation applicable to both straight and slope sides is being evolved at Richardson Scale Co.

Jannssen's Equation:

$$P_v = \frac{wR}{K\mu'}\left[1 - e^{-\frac{K\mu' h}{R}}\right]$$

P_v=pressure on base, lb./ft.²
R=hydraulic radius, ft
K=ratio of lateral & vertical pressures in bin
μ'=coefficient of friction of material against bin wall
h=height of material in bin above base, ft
w=specific weight, lb./ft³

(Continued on page 6a)

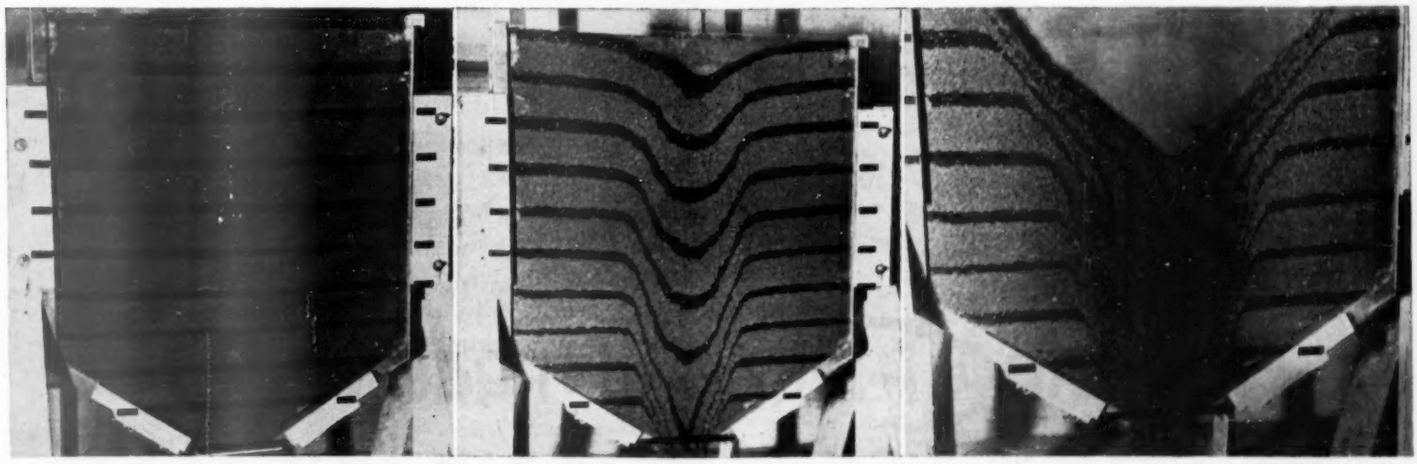

Fig. 2—Free-flowing material is discharged from a bin. (a) The picture on the left was taken prior to discharge. Lines are thin layers of darker-colored material. (b) In the second picture, taken immediately after opening discharge gate, only material over discharge opening is flowing. (c) The third picture shows flow taking place largely in the central column. Upper surface is flowing into the central column. Angle of slide is not equal to angle of repose.

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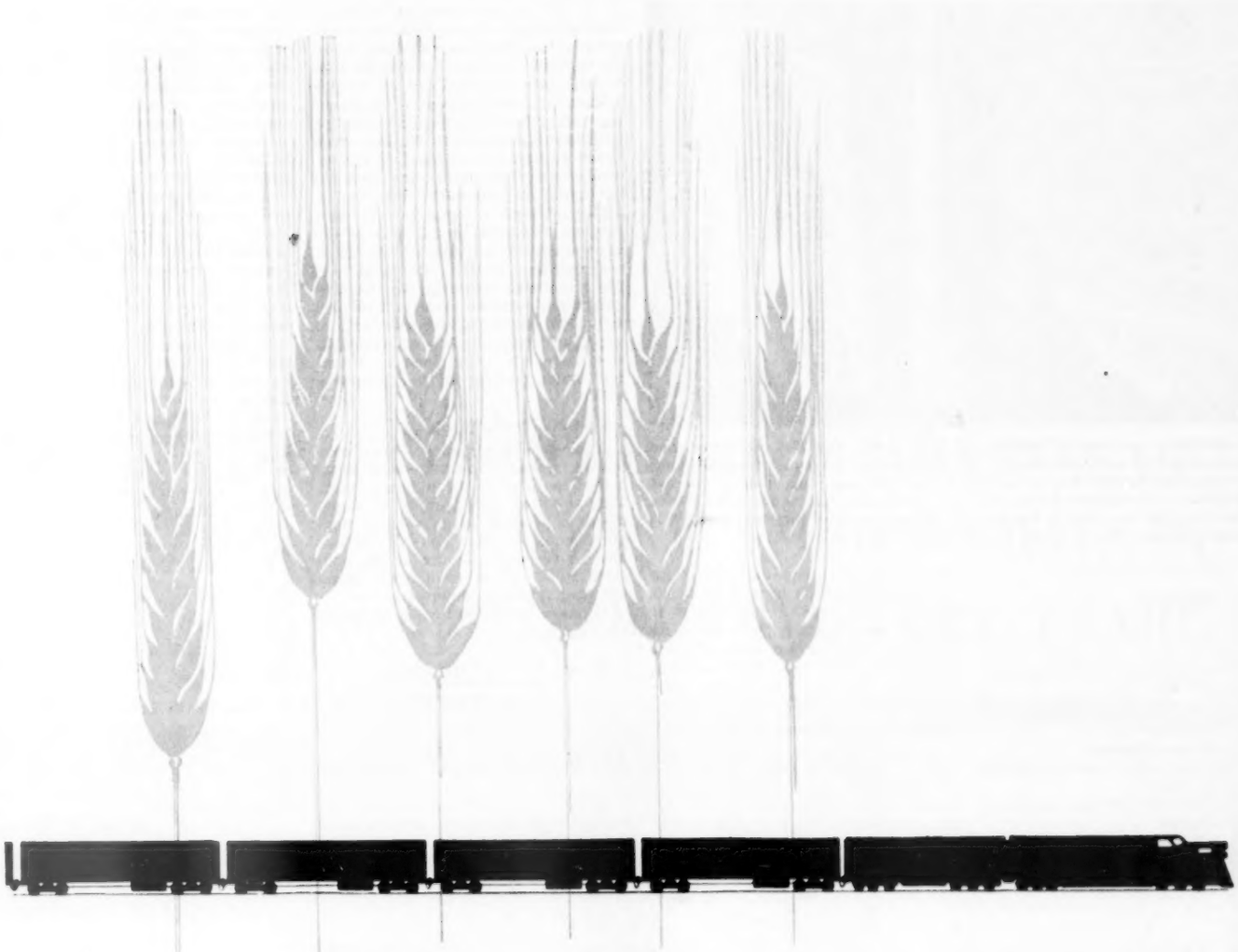

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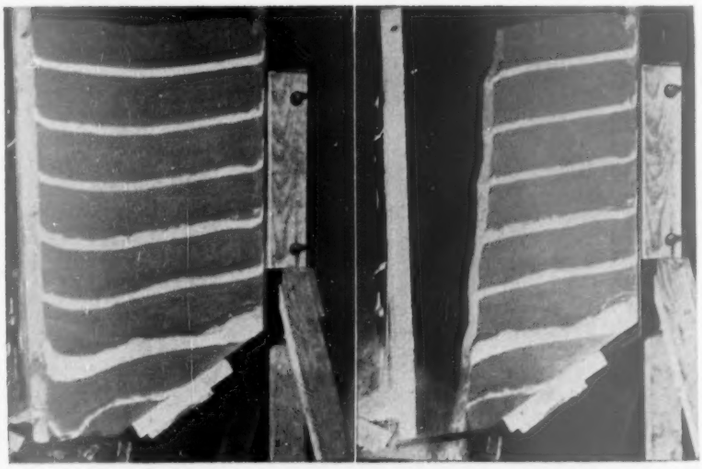

Fig. 3—Cohesive material is discharged from a bin. (a) The picture on the left shows material before discharge. (b) The second picture was taken immediately after the central column moved out. It left as a plug, leaving this rat hole. Rapping was required to get the rest of the material to move out. Tests indicated that the key design feature governing flow was the size of the discharge opening, in relation to the proportions of the rest of the bin.

(Continued from page 3a)

Airy's Equation:

$$P_v = \frac{wD}{K(\mu+\mu')}\left[1 - \frac{\sqrt{1+\mu^2}}{\sqrt{\frac{2h}{D}(\mu+\mu')+1-\mu\mu'}}\right]$$

D=discharge diameter

μ'=coefficient of friction—material against bin wall

μ=coefficient of friction—material against material

First step in the investigation consisted of setting up experiments to check Jannssen's equation. We chose Jannssen's equation instead of Airy's because the basis underlying it seemed fundamentally more sound. At the same time, it is a much simpler equation to work with. These assumptions, as experimental results indicated, were justified.

Test No. 1—Jannssen's Equation

To check Jannssen's equation, we built a series of small hoppers—a straight-sided hopper and hoppers having 5 and 20 degree slopes from the vertical. A hydraulic cell was placed under the hopper at the discharge opening. Tests were run using ⅛ in. polystyrene granules, Portland cement and dry mash feed. Pressures on the full discharge opening were determined for known heads of material in the hopper.

Results of the tests with the circular, straight-sided hopper checked with theoretical values obtained from Jannssen's equation. But they also indicated that Jannssen's equation did not apply for slope-sided hoppers.

Our prinicpal interest in these and subsequent investigations was in the hard-to-handle materials. There is no real problem handling dry free-flowing materials. However, we investigated non-cohesive materials to permit us to make comparisons, and to see if an understanding of non-cohesive materials would lead to a better understanding of the cohesive solids.

Test No. 2—$P_l/P_v=K=?$

After preliminary tests were concluded, we felt a more general equation than Jannssen's could be written. This equation would apply to slope-sided as well as straight-sided hoppers. However, first K (ratio of lateral to vertical pressure of the confined solid) would have to be found for the materials undergoing test.

K has a theoretical basis as shown by Rankine:

$$K = \frac{1-\sin\alpha}{1+\sin\alpha}$$

α = angle of repose

However, this applies only for materials in an unconfined condition. To date, only a few values of K for confined materials have been determined and published, and those by Jannssen for dry grains.

To get values for K we had to design a testing machine and run our own determinations. The device, which we called a K-determinator, consists of a tank into which is placed a cylinder whose walls are made of extremely thin flexible rubber and whose ends are rigid.

A sample of material is placed in the cylinder and the cylinder installed in the tank. A given pressure is then established inside the tank, creating a known lateral pressure on the sample. A vertical pressure then is applied by a piston on top of the cylindrical sample.

Vertical pressure is increased until the rubber walls start to give way. At this point, the vertical and lateral components have been determined. Thus, P_l/P_v equals K.

We have found that K varies with height of material in the hopper and the diameter of the hopper. Therefore, in determining K, we choose the height-to-diameter ratio of the test cylinder to comply with the hopper configuration under investigation.

Right now, with the values of K determined, we are able to check test results with theoretical figures, and to chart test and theoretical curves (Fig. 1). From this data, we are confident that a general equation can be evolved.

Test No. 3—Flow Inside Bins

To study flow inside bins, a bin cross-section was built with a plate-glass front, metal back and with an adjustable discharge opening and tapering lower sides.

Using cohesive and noncohesive materials, we made several studies of flow behavior with several bin con-

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figurations. For close observation, slow motion pictures were taken of the flow of material from the bin.

Results of these tests indicate that:

(1) A central column of flow exists above the discharge opening and is as wide as the opening. If material was being put into the bin at the same rate as it was being withdrawn, material outside the area of the central column consequently would remain static.

(2) Material flows into the central column area as soon as the central column is discharged (Fig. 2).

(3) With cohesive materials, a central "plug" moves out when the discharge gate is opened, and may leave a rat hole (Fig. 3). To get further flow in this case requires rapping or hammering on the bin.

Flow, we believe, occurs when a stress is set up that overcomes the shear strength of the material. It is possible to find the shear strength for a material in any bin configuration. We have designed apparatus that will permit us to determine it by measuring the force required to make a known plug of material shear against surrounding material.

Stress depends on the characteristics of a material and on the design of the bin. It can be determined as soon as a reliable equation has been evolved. When we know both stress and shear strength, we will be able to predict conditions governing flow in a given process.

To confirm theoretical findings, we plan to build experimental hoppers. We should be able to build a hopper with a certain discharge opening that will permit flow, and another hopper with a slightly smaller discharge opening that will not allow flow.

—BREAD IS THE STAFF OF LIFE—

Technique of Grain Orientation for Radiographic Analysis

● By NORMAN M. DENNIS
U.S. Department of Agriculture

The accurate examination of wheat or other grains for hidden infestation by the radiographic method requires a systematic arrangement of the kernels on the X-ray film. If random arrangements are used, considerable time may be consumed in reading the finished radiograph. Expensive films, chemicals and more time may be wasted by too loosely grouping the kernels. At the other extreme, a crowded sample will produce results that make accurate evaluation impossible.

Various techniques have been suggested for orientation of the kernels of grain in preparation for the radiographic examination. A series of small lateral V-shaped furrows produced by crimping a heavy grade of cellophane has been used. The lateral furrows are filled by sprinkling the sample of grain over them. A slight jar will upset the arrangement. Grooved plastic has been tried, but radiographic details in the sample are obscured by the X-ray's transversing the plastic. Assorted grills or pens have been used, but they too are tedious to load.

The soda-straw technique described herein has been found to be a very satisfactory method for conserving film as well as reducing the preparation and examination time of each sample. It also affords a convenient way of handling the grain samples for storage, identification, and re-examination at a later date, if this be desired.

Soda straws are inexpensive and can be obtained very easily in various diameters. The choice of diameter will depend on the kind of grain being examined. The common size 4 mm. in diameter is ideal for wheat kernels. Cellophane soda straws are more convenient to work with, since the tightness of the packed wheat kernels inside the straw can be observed; however, with a little experience comparable results can be obtained with paraffin paper straws.

Individual soda straws can be loaded with wheat kernels in about two seconds with the use of suction from a small vacuum pump or aspirator. A good holder for the straws can be quickly constructed from a 3 in. section of 5 mm. o.d. glass tubing having a wall thickness of 1.05 mm. A 1 in. section of light gum-rubber tubing 3/16 in. i.d. is slipped ½ in. on one end of the section of glass tubing. The remaining ½ in. end of rubber tubing forms a receptacle cup for the soda straws. The other end of the section of glass tubing is connected to the vacuum line. The internal diameter of the glass tubing is small enough to prevent sucking wheat kernels down the vacuum line. The irregular shape and size of the wheat kernels make it impossible to clog the straw by reducing the vacuum during the loading operation. When the straw has been filled, it is removed from the receptacle cup and each end is crimped with the fingernail to confine the kernels. Each straw can be marked with ink or other method of identification.

A fully loaded 8½ in. soda straw will hold about 45 wheat kernels. These kernels will remain in the same order until the straw is unloaded. One hundred and forty four of these soda straws, giving a total of 6,480 kernels, can be radiographed side by side in a grain X-ray machine on a 14x17 in. X-ray film.

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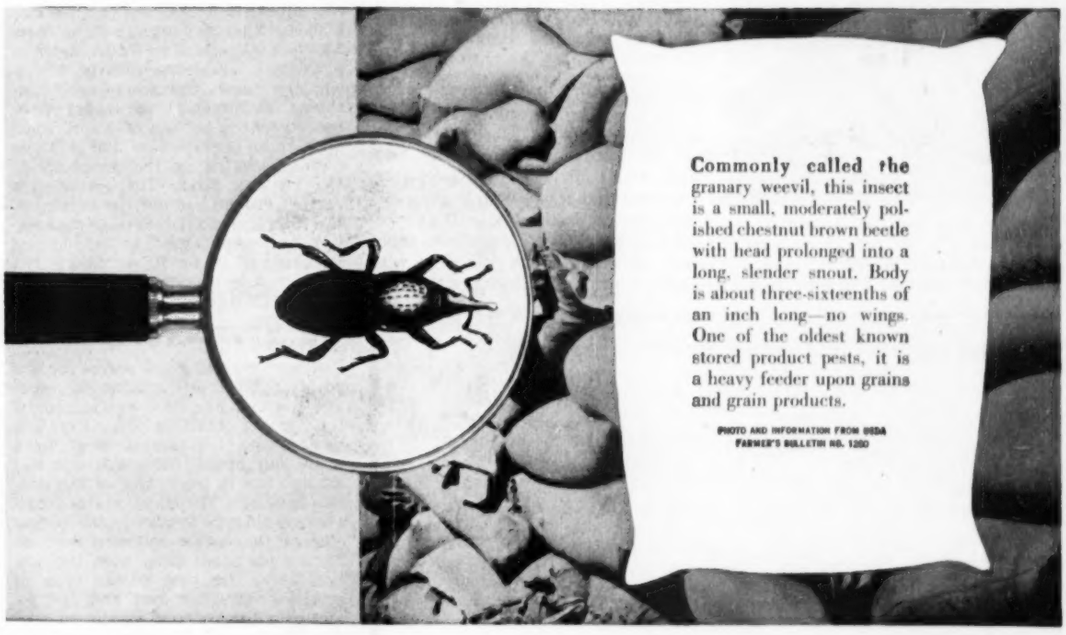
Commonly called the granary weevil, this insect is a small, moderately polished chestnut brown beetle with head prolonged into a long, slender snout. Body is about three-sixteenths of an inch long—no wings. One of the oldest known stored product pests, it is a heavy feeder upon grains and grain products.
PHOTO AND INFORMATION FROM USDA FARMER'S BULLETIN NO. 1250

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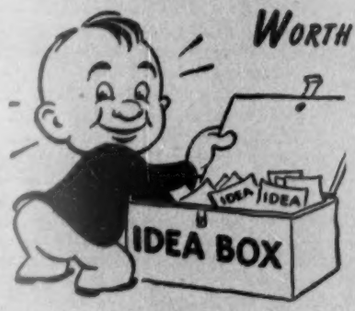

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No. 2775—Truck Dumper

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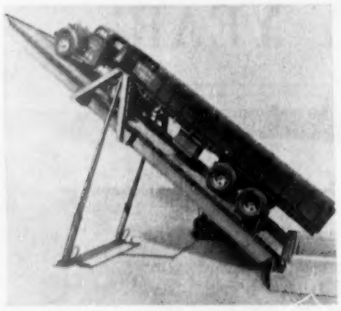
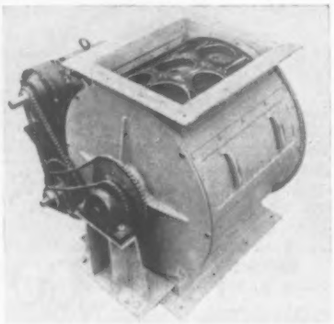


long has just been announced by the Link-Belt Co. It lifts trucks with gross weight of 80,000 lb. to a 40° angle in 60 seconds and lowers them in 40 seconds, it is claimed. It has two 20 h.p. motors directly connected to hydraulic pumps. Either motor is capable of lifting the platform and fully loaded truck. Two four-sleeve hydraulic telescoping cylinders pivot at the base of "A" frames on either side of the platform. Remote control equipment permits one-man operation. The platform is heavily reinforced to prevent twisting or torsional bending. Wide separation of pivot points and low center of gravity provide stability, the company states. Heavy hydraulically controlled stops block the rear wheels of the truck. The dumper can be furnished in platform lengths from 40 to 60 ft., for grade-level or pit operation or for use with scales. The 50-ft. size handles semi-trailers up to 54 ft. long, the maximum allowed on the roads in most states. Folder No. 2482, just released, provides information about the hydraulic truck dumper, with photographs and dimensional information. To get a copy check No. 2775 on the coupon and mail it.

No. 2776—Feeder

A new rotary feeder, developed by Richardson Scale Co., is said to handle exceptionally sticky or flushy materials. Class of materials includes non-corrosive chemicals, feeds, grains, food products and similar materials. Key design feature is a rubber pocket that increases and decreases in volume when charging and discharging. There are 36 pockets; each one 5 in. in diameter. These pockets tend to suck in product with a minimum displacement of air, and



urge material out at discharge. The machine thus acts like a positive displacement pump. Outputs range from 300 to 1,000 cfh. The feeder delivers a uniform flow, runs silently, is self cleaning and completely self-contained. In operation, the feeder is attached to the bottom of a bin. Feed drops into the machine and fills the pockets located on the periphery of the feeder's drum. The material is carried around and out the bottom of the machine and delivered to processing equipment. Openings on top and bottom are 15 by 19 in. Check No. 2776 on the coupon and mail it to obtain full information.

No. 2777—Nozzle

A new type of hand nozzle for use with industrial and commercial vacuum cleaners has been announced by the Breuer Electric Mfg. Co. The new nozzle features a steel back horse hair brush that snaps into two spring clips in the center of the nozzle opening. The firm states that, whereas old type brushes at the perimeter of the nozzle collected dust on the outside areas away from the suction area, the new center type of brush accumulates dust and dirt directly in the path of maximum suction. The nozzle is made of polished aluminum encircled by a resilient plastic bumper to prevent scratching or marring of polished surfaces. A 6-in. shank on the nozzle serves as a hand grip after insertion into the hose, and is notched to fit extension handles. Literature and prices are available by checking No. 2777 on the coupon and mailing it to the address provided.

No. 2779—Hammermill

Bryant Engineering Co. has announced production of its new hammermill, called by the trade name Double-Duty. The company states this hammermill will grind as well as elevate and convey a large capacity for long distances. The unit is designed with one large, full scroll, properly proportioned fan which is mounted directly on the motor shaft. This large fan is so located that it draws the feed straight through the mill into the eye of the fan. The mill is so designed that the large 1,800 r.p.m. fan, operated by a separate motor, draws air through a specially designed air duct, in addition to drawing air and feed through the screen. There are several sizes of fans available for every mill size. The customer can select the size and h.p. of hammermill he needs to grind his required tonnage, and at the same time select a fan system of the proper size and h.p. to elevate this same tonnage to the desired location. The mill itself retains all of the engineering features of the company's hammermills, high capacity, built-in crusher feeder, built-in magnet, all wearing parts readily accessible, on-the-run quick screen change or the Simplex changer, which permits the changing of screens from the working floor in six sec. The largest in this new series of mills is said to grind 20 tons per hour and have the ability to elevate and convey the material a distance of 150 ft. (farther on special applications). For more information on this hammermill check No. 2779 on the coupon and mail it to the address provided.

No. 2782—Safety Campaign

Encouraged by the past successes with safety campaigns in its own plants, the Hudson Pulp & Paper Corp. has announced its first step in a campaign to cooperate with its Multiwall Sack customers in the promotion of industrial safety. The first feature in this campaign centers around getting the theme "work safely" in the minds of plant em-

Send me information on the items marked:

- ☐ No. 2775—Truck Dumper
- ☐ No. 2776—Feeder
- ☐ No. 2777—Nozzle
- ☐ No. 2779—Hammermill
- ☐ No. 2782—Safety Campaign
- ☐ No. 2785—Lift Truck Attachment
- ☐ No. 2793—Automatic Tagging
- ☐ No. 2796—Magnets
- ☐ No. 4013—X-ray Film
- ☐ No. 4014—Level Control

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Cut Labor Costs $1040

One man loads the Hytrol. No heavy lifting, just tip the bag against the belt. Another man at the top places the bags. According to a Wyoming user, these two men with a Hytrol stack more bags than four to six men did manually.

If you use your Hytrol 10 hours a week you save a minimum of two men's work or 20 man-hours. Twenty man-hours a week saved will total $1,040.00 in just one year.

This sturdy Hytrol is built to last a lifetime. Cuts labor cost of stacking, loading, unloading. Roll where you need it, moves bags or boxes in either direction, saves $1,040.00 or more a year used 10 hours a week.

For all facts and prices write:

Your complete source of finest testing and handling equipment.

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ployees. To this end, Hudson is distributing through its salesmen, visored, fabric, shop caps which in themselves are usually worn to protect the hair from chemicals, dust, and other particles found in the air, especially under sack filling conditions. The cap, in sparkling white, features the slogan "work safely" in large red letters. Further information on this campaign may be obtained by checking No. 2782 on the coupon and dropping it in the mail.

No. 2785—Lift Truck Attachment

A swinging clamp attachment which can reach out to either side of a narrow aisle to grasp or tier loads behind material already stacked, is now available for use with all gas and electric-powered carloader models of fork lift trucks manufactured by Clark Equipment Co., industrial truck division. While the unit can also be adapted for heavier machines, the maximum capacity for the attachment is 600 lb., regardless of truck capacity. This is due to the side stability problem inherent in a long, overhanging boom. The clamp device, designed especially for use where aisle space is at a premium and where load removal and tiering are selective, has a full 180° traverse. A wide range of gripping reaches is available, either by hydraulic shift alone or by combination hydraulic shift and manual adjustment of the rear pad. The latter can be adjusted hydraulically for the first 30 in., and with the outer clamp extended up to a maximum 101 in., then adjusted up to an additional 30 in. hydraulically, providing a 13 in. to 42 in. clamping range. With this system unit loads of almost any size may be handled in any position, it is claimed. Compact design for the device is achieved by telescoped construction of the dual slide clamp arms. Slide arms are made of specially treated rolled alloy steel. The swinging clamp is readily detachable and interchangeable with other standard attachments. Pivoting ability is provided by a sealed motor. Check No. 2785 on the coupon and drop it in the mail to receive more information.

No. 2793—Automatic Bag Tagging

The application of tags to feed bags may now be accomplished entirely automatically through a new development on the Bag-Tagger, offered by Mill Engineering Co. The new device uses compressed air and a valve operated by the feed bag may be positioned to center the tag on the bag. This results in more uniform appearance and a minimum of tag loss, the company says. Most important is the freeing of the operator completely of the tagging responsibility and allowing additional time for handling the sewing operation, it is stated. This is especially desirable when one man does both bagging and sewing. The entire machine is very simply and sturdily built to provide long service with little maintenance, according to the manufacturer. Further details may be obtained without obligation by checking No. 2793 and mailing the coupon.

Larvacide
CHLORPICRIN
Kill includes egglife and larvae. Destroys rodents without carcass nuisance. Cylinders 25 to 180 lbs., or handy 1 lb. bottles.
LARVACIDE PRODUCTS, INC.
117 Liberty Street, New York 6, N. Y.

No. 2796—Magnets

A new sales brochure is ready for release by Prater Pulverizer Co., outlining the importance of magnetic protection in industrial processing operations. This six page brochure is designed to assist process engineers, plant managers, superintendents and purchasing agents, in the selection of proper equipment to safeguard costly machinery and material in process against the destructive forces of tramp iron. Illustrated with photographs, line drawings, and dimensional charts, the literature provides full explanation of the range of application of the single gap, double gap heavy duty and hump chute magnets in food processing, heavy chemical operations, etc. To receive your brochure check No. 2796 on the coupon and mail it to this publication.

No. 4013—X-Ray Film

An industrial x-ray film suitable for use with x-ray machines designed for detection of hidden infestation in grain has been developed by E. I. du Pont de Nemours & Co. The manufacturer states that very satisfactory results have been obtained by brief exposures on Du Pont fine grain industrial x-ray film and for extremely critical examinations, a very fine grain x-ray film may be used. Further information about the film may be obtained by circling No. 4013 and returning the coupon to this journal.

No. 4014—Level Control

A level control for the control of dry materials in bins has been introduced by the Scrayco company. The

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NOTHING BUT THE BEST!

Since the 1840's SWISS SILK has been the standard bolting cloth of the milling industry.

No effort has been spared to maintain the high quality of manufacture and top operating performance of this superior textile.

Raw materials of the finest, superb craftsmanship and meticulous inspection bring to the miller of today, as it did to his forebear a century ago, the best bolting cloth in the world.

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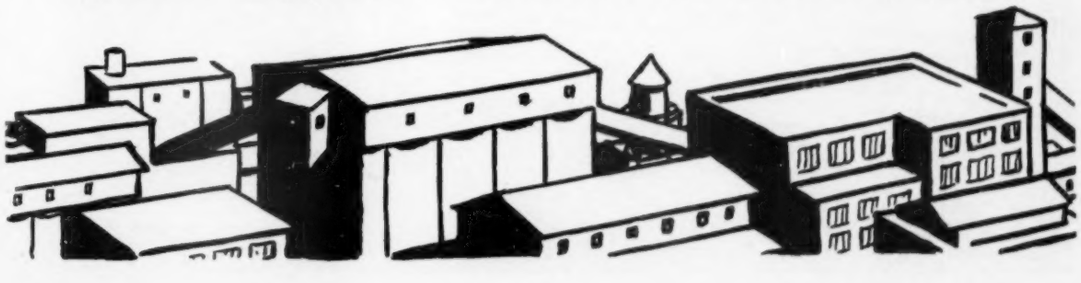

shut-off device, invented by Eugene J. Scray, is said to operate with a great variety of dry materials. A sealed housing is bolted on the outside of a storage bin. The housing contains a switch, connected with a spring, adjustable for sensitivity, which in turn is hooked to a rod running through a rubber sphere on the side of the housing next to the wall of the bin. The sphere is enclosed in a housing that separates the switch housing and the interior of the bin. The rod running through the flexible sphere bends downward inside the bin and may be angled to any degree from the horizontal. This rod, called the sensing probe, is the part that comes into contact with the flowing material and, moving through the flexible sphere, works the spring to throw the switch that cuts off the flow at the desired level. When the probe goes downward due to weight of the materials reaching it, the electrical contact breaks and the flow stops. Further information may be obtained by checking No. 4014 on the coupon and mailing it to this journal.

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It Grips — Leather's resilient, frictional surface "bear hugs" the pulley face, causing belt and pulley to move as one power unit.

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GRATON & KNIGHT *Company*

WORCESTER, MASSACHUSETTS

World's Largest Manufacturer of Industrial Leather Products

Sack Silos

(Continued from page 1a)

ucts left the plant by truck and that foremost attention would have to be given to the problem of efficiently loading a large number of trucks in a limited dock area. The management realized that this was a new problem, since before the war the majority of the mill's products left the plant by rail. Management searched for a new solution, in the course of which existing sack silos were inspected.

Four Operations

The entire flour storage installation at Auer can be divided into four operations:

(1) Receiving of flours from the mill.

(2) Storage in bulk flour cells.

(3) Packing and storage of bags in the sack silo.

(4) Dispatching from the sack silo.

The first two operations are handled in the conventional manner. A sack silo does not replace bulk storage, it supplements it; in fact, storage is only a secondary function of the sack silo. The packing is accomplished on conventional packers located on the tenth floor near the inlet openings of the sack silo. Baffles on the inlet openings actuate the counting device registering incoming sacks. The sack silo is subdivided into two sections of 18 slides each. Twelve slides can serve each dock loading point directly. In addition there are two reversible belt conveyors under each section of the silo, so that actually each slide can service every loading point and a transfer belt to the railroad and boat dock. Two other reversible conveyor belts are provided at the head of the sack silo to reduce manual handling at that point.

Each slide is about 250 ft. long and holds 90 to 100 sacks of 100 kg. The total length of the slides is about 9,000 ft. Located at the lower end of each slide is a rotary valve driven by an individual motor. This motor is energized when sacks are delivered from the particular slide.

Operation of the System

The entire loading operation is supervised from the central control station. The operator of the control station orders approaching trucks to one of the three loading points. A loudspeaker is provided for that purpose. After the vehicle is backed up to the platform, a retractable, suspended loading belt conveyor is pulled into the truck—it can be extended about 11 ft. in. Next, the operator of the control station connects by plugs the outlet for the loading point with the outlet of the slide from which the sacks are to be withdrawn. Every loading point can be connected with every slide. He then sets the number of sacks required on an electrical counter.

The interior of the sack silo. This view was taken at an angle, looking down the slides.

This picture shows the packing floor with inlet openings to sack silos and indicating panel. Sack labels, indicating which types of products are stored in the various slides, are attached to the indicating panel.

The loading mechanism is now ready. Since, however, the truck crew may not be ready to receive yet, the sacks do not start rolling immediately. Instead, a green signal lights up at the loading point. The truck crew then presses a push button on the dock underneath the pilot light, which actually starts the rotary delivery valve. Adjacent to this push button is a control knob for the truck crew to regulate the speed of delivery according to the capacity of the loading team to handle bags.

The mechanism of speed regulation is quite simple and does not require variable speed motors or reductions. As each sack is pushed off the lowest point of the slide by the rotary delivery valve, it engages a bar which operates a switch stopping the valve motor. The period during which the motor is stopped until it starts again is adjusted by the delivery speed knob. This arrangement, giving the truck crew control over start and speed of delivery, seems most practical. It also frees the control post operator from the obligation to keep a constant watch over all three loading points. In case of trouble, the loading process can be stopped by the truck crew by engaging another button. The control station can also interrupt a delivery.

After the number of sacks set on the counter has been delivered, the valve motor is de-energized and no further products can be withdrawn unless another number is set on the control station. The control panel is equipped with a number of counters. It is possible to read off the number of bags loaded on each vehicle and the number of bags loaded by each loading point during each day or week.

Running Inventory

Since it is desirable to have a running inventory of the quantity of bags stocked on each slide, every slide is provided with a differential counter. This automatically adds all sacks dropped into the slide and subtracts the number of sacks delivered, so that the actually available number is indicated on the counter. Another instrument shows the total

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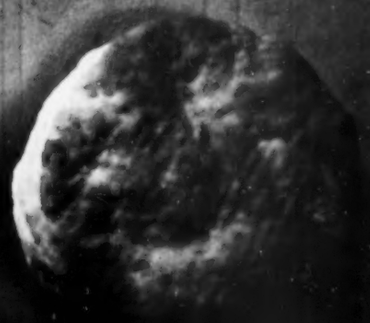

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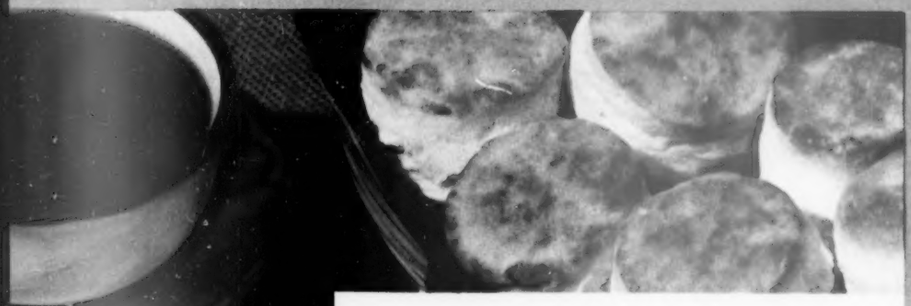
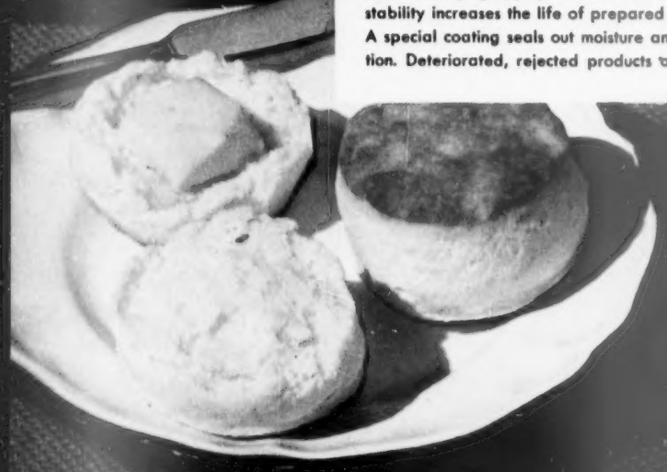
Tests Show Greater Stability of PY-RAN Increases Volume of Baked Goods



PY-RAN'S* stability increases product shelf life. Your customers get light, fluffy biscuits like these, as PY-RAN controls the effects of aging. Aging tests conclusively prove PY-RAN'S superior stability increases the life of prepared mixes and self-rising flour. A special coating seals out moisture and retards premature reaction. Deteriorated, rejected products are reduced to a minimum.



Fluffy or thin, you can get exactly the type pancake you want for your mix by using PY-RAN or Monsanto HT phosphate or a blend of both.

Longer shelf life for cake mixes results when PY-RAN is used. And best of all, PY-RAN blends unusually well with SAPP to give exactly the formulation you desire.

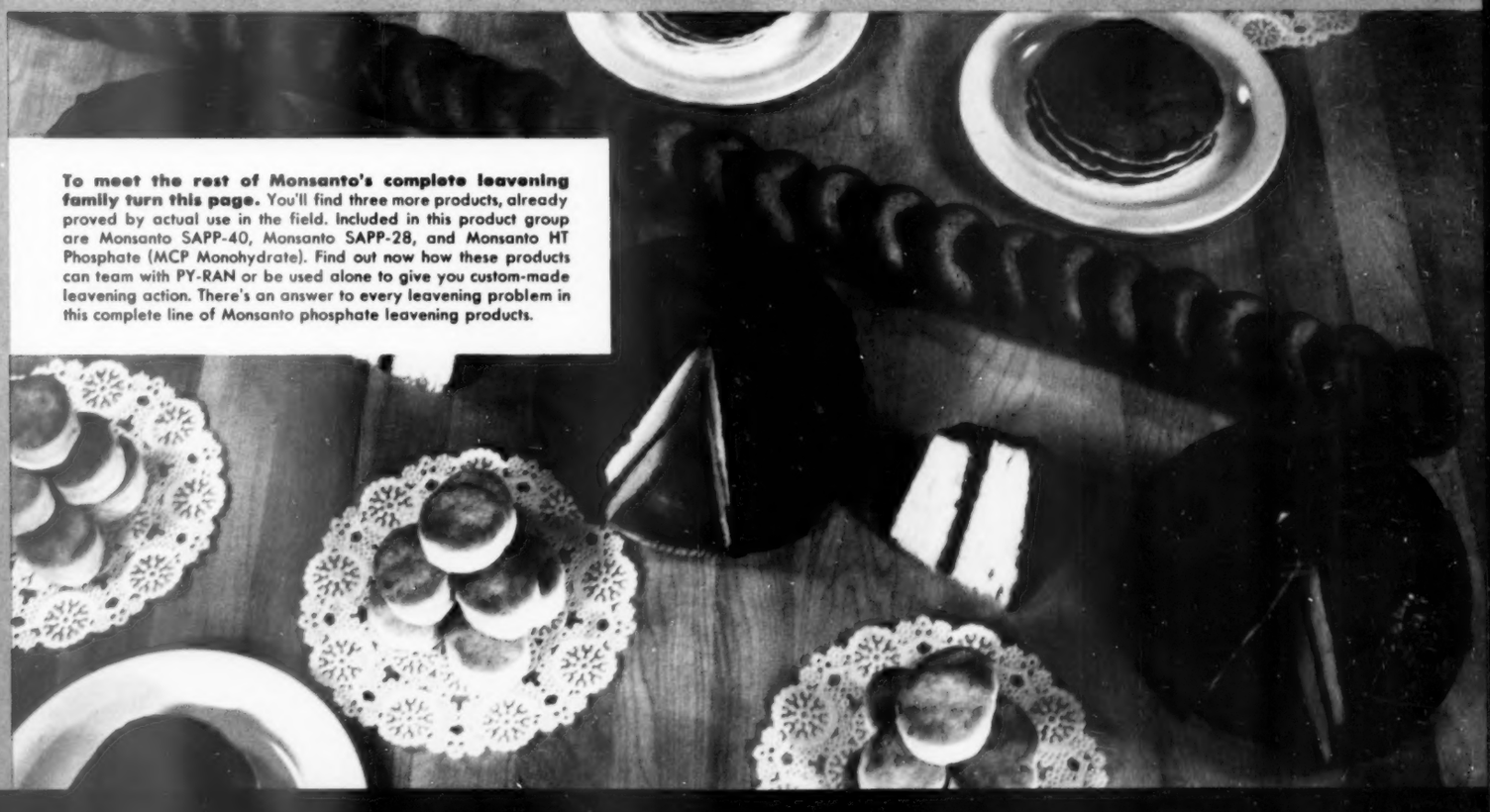
TESTS PROVE **PY-RAN** GIVES SLOWER, CONTROLLED CO_2 RELEASE DURING CRITICAL FIRST 2 MINUTES OF MIXING

PY-RAN'S greater stability means controlled release of gas even after long storage. Tests clearly prove how PY-RAN releases CO_2 slowly during first two minutes after dough or batter has been made. This two-minute reading is especially important, as any CO_2 evolved prior to this time will be unavailable for leavening action in baked goods. PY-RAN holds this gas for release at the proper time—during baking.

A slow, controlled gas release as produced by PY-RAN minimizes tunneling, coarse texture and other troubles. A baked product is produced which has improved texture and a uniform, small-cell structure.

PY-RAN'S stability also adds increased tenderness. Baked goods are friable, no longer possess the toughness caused by poor, uncontrolled leavening.

Test this product for yourself and see how PY-RAN'S controlled CO_2 release can improve your prepared mixes and self-rising flour.



To meet the rest of Monsanto's complete leavening family turn this page. You'll find three more products, already proved by actual use in the field. Included in this product group are Monsanto SAPP-40, Monsanto SAPP-28, and Monsanto HT Phosphate (MCP Monohydrate). Find out now how these products can team with PY-RAN or be used alone to give you custom-made leavening action. There's an answer to every leavening problem in this complete line of Monsanto phosphate leavening products.

There's an answer to every leavening problem in the complete family of Monsanto Phosphate Leavening Agents

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Monsanto SAPP-40 . . . ideal for machine doughnut mixes. Gives a fine texture and crust. Reduces tunnels. Cuts down on grease absorption, improves doughnut's shape. Here is a product that gives uniform action—*every time.*

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Monsanto HT Phosphate (MCP Monohydrate) . . . versatile, effective, contains no free phosphoric acid, hence does not attract moisture and cause premature reaction with soda. Use it alone or mix with other Monsanto leavening agents for good results.

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The central control station

number of sacks withdrawn from the slide within certain intervals. This can be used to check the reading of the loading point counter described in the preceding paragraph.

To guide the packing crew, the panel indicating the inventory of each slide is duplicated on the packing floor. In addition an alarm bell sounds there when a slide has been filled, and a pilot lamp lights up at the full slide. The pilot light turns itself off as soon as material has been withdrawn from the slide and more sacks can be filled in. Communication between various points of operation over the entire system is maintained by means of a public address system.

The slides in the sack silo are constructed of wood. These are supported by steel beams and columns. The entire installation is located alongside the bulk flour bins. The holding capacity is about 3,600 sacks of 100 kg. Maximum delivery is 1,500 sacks per hour. Actual delivery at each of the three loading points can be adjusted from 300 to 500 sacks per hour; this range is based on the capacity of the customary two-men loading crews. The bulk flour and sack storage is housed in a 12-story building which is almost 150 ft. high and covers an area of 100x60. The 20 flour bins hold from 130 to 150 tons each. Within the storage building there are 16 belt conveyors, two sack elevators and about 100 electric motors.

This interesting development for dispatching sacks warrants close study. During the last few years considerable research and practical tests were conducted in this country on bulk shipments. In American practice, small packages are already filled and conveyed by automatic equipment. Sack silos may satisfactorily fill the gap between these methods, making possible efficient dispatching of all mill products.

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Haltmeier, Otto — Sacksilos. Die Muehle 90:5 (1953).

Photos: Courtesy of "Die Muehle"

—BREAD IS THE STAFF OF LIFE—

ANDERSON APPOINTMENT

CLEVELAND—Roy L. Brittain has been elected treasurer and director of the V. D. Anderson Co., according to an announcement by Carl W. Zies, president. Comptroller of the V. D. Anderson Co. since 1948, Mr. Brittain will continue to head the bookkeeping, cost accounting and budgeting departments of the firm, a subsidiary of Chesapeake Industries.

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A spray - concentrate combining residual and contact properties. Dilution with water makes a highly effective, economical spray for elevator or farm bins. Safest of common residuals.

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A synergized allethrin dust recommended solely to prevent or halt grain surface infestation. More potent than other grain dusts. The real answer to surface moth infestations. Non-poisonous, safe to handle.

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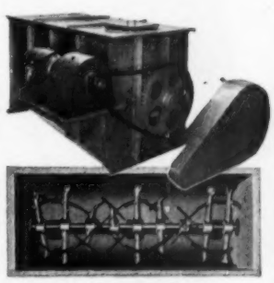

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Initiation and Termination of Research Projects

By C. G. Harrel and Howard W. Lincoln
Pillsbury Mills, Inc.

PART I

The problem of initiation and termination of research projects requires clear foresight into the future. Entailed are decisions which cannot be made competently by any one man but require the cooperation of, or at least consideration of the thinking of personnel in departments of the business organization other than research. This has been emphasized recently by several capable men high in prominent research-minded organizations.

Charles Mortimer, executive vice president of General Foods Corp., in an address entitled "Food Industry Trends and National Defense" delivered before the Research and Development Associates, Food and Container Institute, Inc., in Washington, raises the following questions: Will soluble products, like coffee today, be established in other lines? Will vegetable fats replace dairy fat and will synthetic fats then replace many of our natural fats? Will new weight-reducing foods take the strain out of dieting? How will people want to live and eat?

In answer to these questions he says, in part: "Clearly, you will have a lot to do with that future. A great deal will depend on your ingenuity. And on how you interpret the trends, how you apply them to our industry, how you decide which projects should have priority. Other functions of business will find the way to manufacture and distribute new product ideas. But business looks to you to dream up new ideas.

"This is a complicated world, getting more complicated all the time. It's a demanding world, demanding more all the time. And so we must

EDITOR'S NOTE: The accompanying article is the first of two articles dealing with the initiation and termination of research projects. The articles can be of great help to persons in research and technical positions in flour milling and other branches of the food industry. They also contain information of real value to company management. The articles are a condensation of a paper presented at the Industrial Research Organization Institute at the University of Wisconsin. Mr. Harrel is director of food research for Pillsbury Mills, Inc., Minneapolis, and Mr. Lincoln is section leader of the cereal chemistry section of Pillsbury's research and products development department. In preparing the paper, the authors consulted with 40 outstanding research directors in the U.S., and the paper thus represents the teamwork of some of the best minds on the subject. The second of the two articles will appear next month.

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NOW! End These Losses with the MAX "dead sure" PLAN!

From farm bin to country elevator to terminal to mill, "BUG-LARS" steal from one-half to four full bushels of every 10 bushels of grain handled. Up to 2 of every 5 grain dollars are lost forever . . . a tidy $400,000,000.00 yearly.

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all be specialists, each with his place on the team."

Thomas H. Vaughn, vice president, research and development, Wyandotte Chemicals Corp., in an article entitled "Calculated Risk—Its Place in Selection, Control and Termination of Research Projects" delivered at the fourth annual conference on Administration of Research, University of Michigan, in 1950, has the following to say:

"One knows that most of the figures he uses are not factual, that they are guesses and that the area of certainty represented by each guess is open to question. One must also allow the judgment of others on some of these points to influence his own thinking, even when he is relatively sure that the judgment being expressed is incorrect. After all, the modern industrial organization moves as a team, and teamwork needs the subordination of individual thinking and judgment to that of the group as a whole."

Both of these gentlemen have stressed the importance of teamwork in research. This paper was developed and prepared by a team—a team consisting of approximately 40 of the outstanding research directors in the U.S.

Before we discuss initiation and termination of research projects, we must note the fact that in most industries, notably the food industry, there are certain fundamental projects which are mandatory and without which the industry could no longer survive. Food research differs from some other types of research in that food products require raw materials which are largely agricultural in nature. The ever-increasing population of this country is placing a greater and greater demand on these raw materials, such as eggs, milk, cereals, etc. For this reason, the food industry is faced with mandatory projects designed to improve the quality and quantity of these raw materials and to devise methods of extending their effectiveness functionally as well as nutritionally.

Let it not be assumed that this required research, largely fundamental, is to be conducted entirely by governmental agencies, universities, experimental farms, or other nonprofit making research organizations. Wise and competent management realizes that it must make its own contribution. Robert G. Ruark, executive assistant to the president, Corn Products Refining Co., in an address delivered before the Food Industries Advisory Committee Meeting, the Nutrition Foundation, Inc., Skytop, Pa., has adequately expressed this thought:

"Management only demands economic research and practical research from his own research organization; but realizes full well that the community needs more than this and that industry must contribute its share. No corporation that devotes all of its efforts to the application of fundamentals developed by others, excluding this type of development from its own thinking, can continue to operate very long in the America of today and the future. Each industrial entity must devote a significant portion of its research endeavors to basic studies of the unknowns peculiar to its own products."

The food industry is accomplishing this in part in its own research laboratories and to a large extent through support of such organizations as universities, experimental stations, crop and stock improvement associations.

An example of this type of effort is research on egg production. With a possible leveling off of egg production per layer and an increased per capita consumption, we have an outstanding research demand project. Otherwise the standards of American living must be lowered with respect to egg consumption.

It is recognized by very few persons that there is research which is mandatory—such as crop improvement, increase in egg production and increase in milk production. These things are so common that most people do not consider them as research. Yet this is the most valuable research because food research is essential and must be increasingly stressed because of our ever-increasing population.

* * *

We are now ready to discuss the problems of initiation and termination of research.

Ninety percent of our team agree

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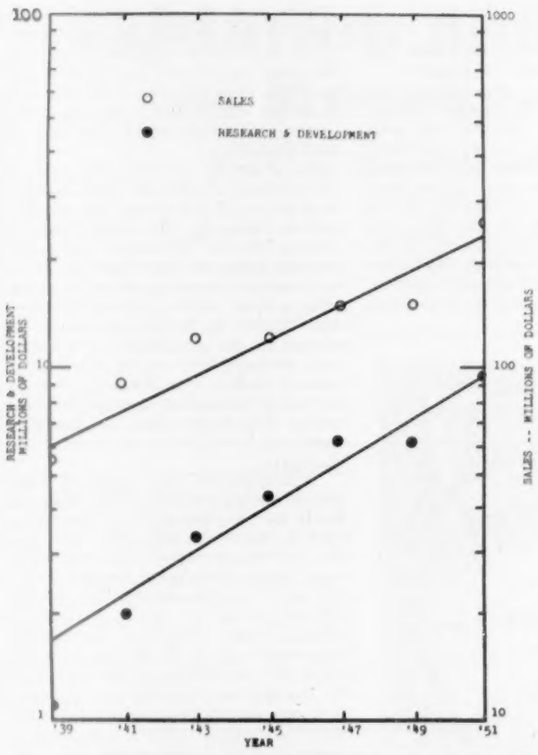

Figure 1 (on the left)—Average research and development expenditures compared with average sales for three American chemical companies.

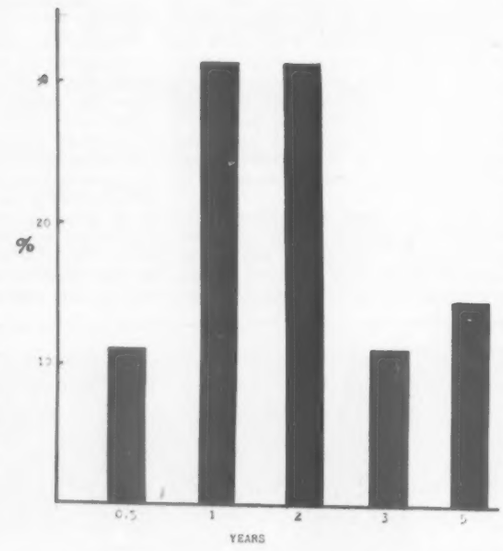

Figure 2 (above)—Time limit for research projects.

that the process of initiating (choosing) is equal to if not more important than the actual process of conducting the research work. Dr. Robert G. Ruark has stated this well when he says:

"The ability to choose a practical project for research is a gift with which few persons are endowed. There is certainly no dearth of ideas, for each individual development creates a new field of its own, and frequently improvements on products have greater value than the original development."

This is very significant and we have chosen one small word for it:

IT

"I" for initiation and "T" for termination of research projects make this small word the big "IT" of research.

The wise initiation and termination of research projects are more important today than ever before for the following reasons:

(1) Industrial organizations are burdened with more taxes, higher material costs, higher labor costs—all of which make it more difficult to make a profit on the capital dollar invested. Research is therefore called upon for its contribution to industry and society so that we might maintain our high standard of living.

(2) The federal government has entered into an extensive research program represented by its many laboratories and grants for research in colleges and experimental stations. These have all required trained personnel. They have increased competition in research and drained the manpower supply. It is therefore highly important that we initiate the right projects to make the best use of the facilities we possess.

3. The results of research and the evaluation of the performance and organization of the various laboratories in industry are so important that in making an analysis of the company's status, banks and industrial executives have come to place particular emphasis on the company's policy for the future. What type of an insurance policy does the company have for future development? What products for the reserve shelf has it developed or is it developing through research? What is the record of performance of its men?

By way of illustration, Fig. 1, taken from "Chemical Investments by John F. Bohmfolk, Jr., published by Chemonomics, Inc., New York, gives an average of the sales of three American chemical companies in relation to their research and development expenditures from 1939 to 1951. (See Fig. 1 on this page.)

Bohmfolk has the following to say on this subject:

"As a practical matter research is one important arm of a well developed program of expansion. Research productivity may not be high in terms of the number of projects successfully completed. One successful project out of every five started may be an optimistic average; however, returns from successful projects are sufficiently rewarding to pay for the unsuccessful projects as well as to finance new projects. In any analysis the assumption that growth, as expressed largely in terms of sales, is derived from research is justifiable for most companies. Thus an appraisal and correlation of sales and capital expenditures with research expenditures is possible. The correlation of research expenditures with sales growth is striking."

More Complex

4. The demands of society for mechanical, chemical, food and clothing products are becoming more complex and demanding. People want food that can be prepared with greater convenience, with better nutrition and more taste appeal. For example, 20 years ago the milling industry was satisfied to produce a flour having good color and baking quality. Today this same industry is permitted to add six enrichment ingredients, four oxidizing agents, one enzyme, and in addition, mill its product to a constant protein, ash, moisture, color and baking quality, making a total of

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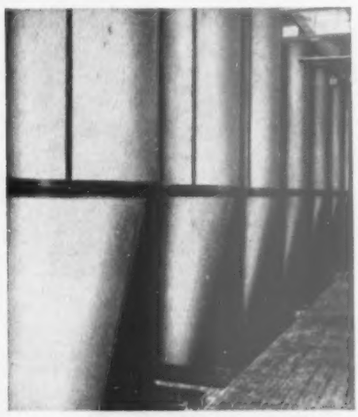

DAY BOLTED BINS (above) are ideal for bulk storage and bulk mixing of materials. They can be installed where other types won't fit and their capacity increased simply by adding bolted sections. If necessary they can be unbolted and moved to new locations with only erection costs to consider.

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17 controllable factors. In order to keep abreast and ahead of competition, research must have a good selection of projects completed and placed on the reserve shelf. The selection of timely projects that will be in use two or three years from now is the key to keeping competitively ahead. This is a challenge because it calls upon research to choose projects resulting in products which will be in demand two to three years from now.

5. In addition to recent research findings, the adoption of definitions and standards of identity for many foods has resulted in the termination of the use of certain products as ingredients of food. Within the last four years the use of nitrogen trichloride as an oxidizing ingredient has been discontinued because of possible toxicity. This necessitated the initiation of research projects which ultimately developed chlorine dioxide, a non-toxic maturing agent, which has replaced nitrogen trichloride (agene). Recently spans and tweens (emulsifiers) have been prohibited in bread, rolls and buns. And American industry has voluntarily withdrawn Coumarin from the American market because of its toxicity as established by its manufacturers. This is a commendable step on the part of industry.

Project Initiation

Let us now consider specifically the project initiation phase.

Projects for initiation must meet one of the following objectives:

(a) Fundamental research exploring the unknown.

(b) The development of new products.

(c) Improvement of existing products or ingredients thereof.

(d) Improvement of an existing process.

(e) The development of new processes or products which present cost reduction.

(f) The development of alternate methods and materials as an insurance policy against strikes, impairment of supply of regular materials and abnormally high cost increases in production method, and raw materials.

With these objectives in mind, our team of research directors was asked several questions concerning current attitudes toward selection of research projects. Three of these questions and their answers follow.

1. What does our team think are the most outstanding trends in the selection of initiation of projects that have taken place during the past seven years?

The answer to this question will be of value to us in helping to choose projects. For example:

(a) They consider increased study of a project prior to selection more important than ever before.

(b) More attention should be given to the mechanics of selecting a research project and greater collaboration with other departments in the company. Our returns show that in 85.6% of the organizations consulted, research does not alone decide which project should be selected.

(c) Our team feels that more widespread use of market research (of particular importance in the food industry) will result in products more acceptable to the consumer.

(d) Operations research and other objective techniques in project selection have become increasingly important.

(e) The improved relationships and coordination between industrial research laboratories and outside research groups are necessary. The increased cost of doing research has made it essential to select services which give the most for the money.

Useful Departments

2. The departments that have been mentioned by our team as being useful in helping research initiate projects are: market research, sales, engineering department, legal department, operating or manufacturing department and advertising.

3. Who are the personnel most valuable to directors of research in assisting with the selection of research projects?

Our team replies indicate in answer to this question that: (a) a man with a Ph.D. degree or equivalent with five to ten years of experience in the organization is definitely considered the most valuable; (b) trained engineers and commercial research men ranked second and third, respectively; (c) operating plant superintendents were fourth; and (d) outside consultants were rated last—all of which indicates that experience within the organization is of tremendous help in the selection or initiation of research projects.

Assistance as to when a project should be terminated may be derived from an examination of records and data. Some suggestions which may be revealed are the following:

1. Excluding fundamental research a project should be terminated if research data clearly indicate that the time of development may extend over a sufficiently long period so that the results would be of doubtful financial value to the organization. If the project extends over five years, it is

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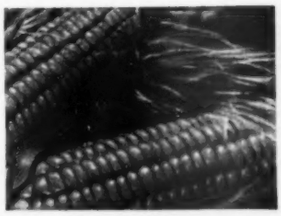
INSIDE SCIENCE

The Vital Story of CORN ENRICHMENT

(CORN MEAL—CORN GRITS)

by Science Writer



Since Pilgrim days corn has been a popular food in American diets. Today dishes using corn meal or corn grits are served at breakfast, lunch, dinner.

As scientific information was gathered about this popular grain, it was found that Nature had been bountiful with certain food essentials and stinting with others. Unfortunately, only small amounts of certain vitamins and other nutrients which are essential to human health were found to be present. Furthermore, unavoidable losses occurred when the grain was degermed. Degerming allows the product to be packaged for nationwide distribution without spoiling.

When corn millers realized this situation, they took an important step to correct it. They used enrichment.[1]

Enrichment is essentially a simple process. It restores important vitamins and minerals to whole grain values. And, in the case of whole corn meal, which is naturally low in niacin and iron, it increases the values for these essentials over whole grain levels.

These are the vitamins used in enriching corn meal and corn grits:

Thiamine, also called vitamin B_1, which helps to build physical and mental health. It is essential for normal appetite, intestinal activity and sound nerves.

Riboflavin, also called vitamin B_2. This vitamin is essential for growth. It helps to keep body tissues healthy and to maintain proper function of the eyes.

Niacin, another "B" vitamin, is needed for healthy body tissues. Its use in the American diet has done much to make a serious disease called pellagra disappear.

In addition to the "B" vitamins, *iron* is used in all enrichment of corn meal and grits. And, at the miller's option, calcium and vitamin D may be added.

Our Federal government and many state governments have established maximum and minimum enrichment levels which the various forms of corn meal and grits must meet to be acceptable in commerce. For instance, the Federal Standards for enriched corn meal and enriched corn grits are as follows:

	MIN. (Mg. per lb.)	MAX. (Mg. per lb.)
Thiamine	**2.0**	**3.0**
Riboflavin	**1.2**	**1.8**
Niacin	**16.0**	**24.0**
Iron	**13.0**	**26.0**
ADDITIONAL AT MILLER'S OPTION		
Calcium	500.0	750.0
Vitamin D*	250.0†	1,000.0†

*Although an optional ingredient, not considered necessary in corn enrichment. †U.S.P. units per lb.

The Federal Standards further provide that the levels for enriched grits must not fall below 85% of the minimum figures after a specific rinsing test.

The enriching ingredients are combined into a form called premix which millers add during processing so that enrichment is spread evenly throughout the product.

The vitamins used in enrichment are manufactured. Scientists first learned the chemical composition of vitamins, then isolated the pure substance. Then they "built" a duplicate. This duplicate is identical with Nature's product chemically and in biological activity. A vitamin is a vitamin regardless of its source, just as salt is salt whether it comes from a mine or is evaporated from the sea. So efficient is large scale manufacturing that vitamins are available to millers at a lower cost than if they were extracted from natural sources.

The Hoffmann-La Roche people, pioneers in research and manufacture, make top-quality vitamins literally by the tons. In fact, a large percent of the vitamins used in enrichment of corn meal and grits, family white flour, white bread, macaroni products, and white rice, come from the Roche plant. Using amazingly complex processes with scientific production controls, Roche employs modern, special equipment which fills whole buildings, each one a city block square and many stories high.

This article, reprints of which are available without charge, is published as a service to millers of corn meals and corn grits by the Vitamin Division of Hoffmann-La Roche Inc., Nutley 10, New Jersey. In Canada: Hoffmann-La Roche Ltd., 286 St. Paul Street, West, Montreal, Quebec.

[1]An excellent color film on the enrichment of corn meal and grits has been produced by Clemson Agricultural College, Clemson, S. C. Widely recognized as an outstanding educational film on food and nutrition it is being shown by many health departments and schools.

Millers of corn meal and corn grits help in the fight against dietary deficiency diseases and in promoting good nutrition when they enrich their products with thiamine, riboflavin, niacin and iron plus calcium.

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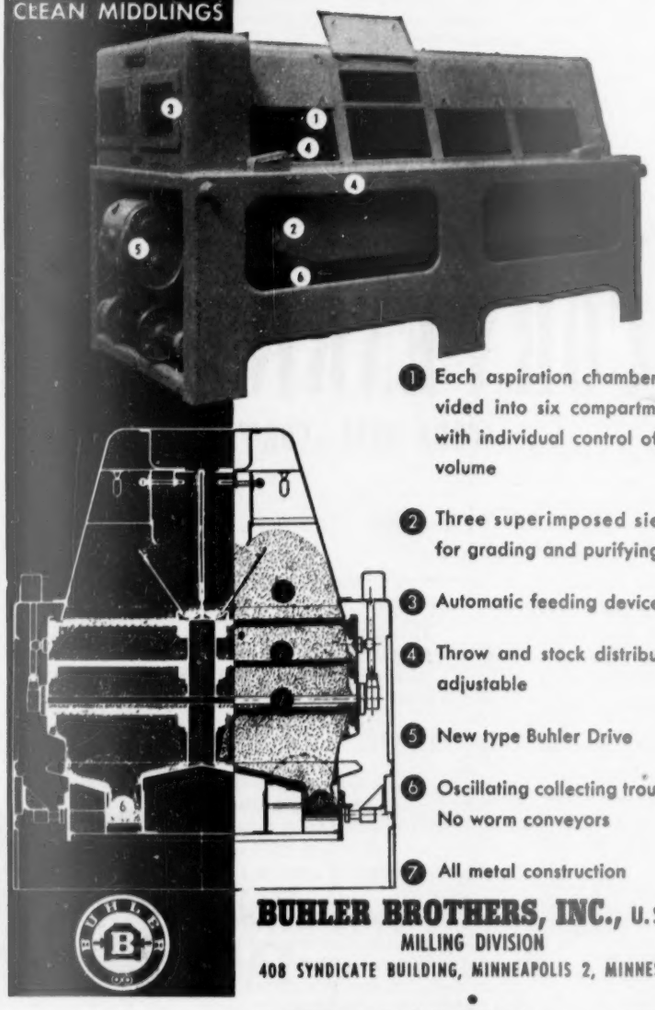

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very questionable that such a project should be continued per se. It may, however, be broken down into simpler projects, some of which may be successful. This has a psychological advantage as progress reported on the individual subdivisions are encouraging both to management and research personnel.

Fig. 2 indicates that our team has chosen a period of one to two years as being the interval beyond which a project cannot be extended without management becoming impatient. (See Fig. 2 preceding page.) This may result in a termination of the project or a decided increase in the tempo of the work.

2. A project should be terminated if competitive research preempts the problem and the market is not capable of absorbing additional products of the type under study. It has been generally true that a product having six months' to a year's marketing advantage establishes itself to such an extent that the competition is very difficult to overcome. A product being produced to round out a company's product line could be a possible exception. Such a product is definitely a customer accommodation.

3. A project should be terminated when existing specifications, standards and definitions of identity or laws are enacted which would make the end-product difficult to market. This is particularly true in the food field.

4. Termination should be considered if it is revealed that there is any evidence of possible toxicity in the finished product. This applies to both products consumed by man and products consumed by animals.

5. Termination would be advisable if it is revealed that the total estimated cost of research and the capital required for the sale and manufacture of the end product have increased so much over the original estimate as to lower the net return to the company to an undesirable figure.

6. A possibility of termination exists if raw materials, processing cost or a decline in market value make the product no longer remunerative.

7. A project should be terminated if a more remunerative or better use has been developed for the raw materials which serve as constituents of the specific product or process being developed, providing the source of such raw materials is limited.

8. Inadequate equipment, manpower or finances may result in the termination of a project. The pace of modern research is so swift that success cannot be attained other than with the best equipment, manpower and finances.

Examples

9. Additional more specific examples which illustrate when a project should be terminated are as follows:

(a) A research project might be terminated when it does not represent a saving or perform a definite service to the consumer, such as easier and better living or lower food cost. This lower food cost not only applies to the cost of the food but also and of equal importance to the time saving made possible by convenient foods.

(b) A food project should be considered for termination upon finding that the product is negative in palatability and appetite appeal.

(c) Certain types of food projects should be given serious consideration for termination if the commodities under investigation do not represent better nutrition. By better nutrition, we mean supplying those elements which are necessary for growth and maintenance of the body functions. We do not refer to caloric value.

(d) Termination of a project should be considered if the storage life (shelf-life) of the product is not sufficiently long to maintain fresh supplies to the consumer.

So that you may have a yardstick to measure the performance of your organization in the initiation and termination of projects, each member of our team was asked, "What per cent of projects selected are successful in that they resulted in a financial return to the company?"

The average of our team shows 38.4%. The range is very wide as would be expected. A few indicated 10% while others gave 90%. This is reasonable depending on the ease or difficulty of the chosen project assuming competent manpower, good environment and adequate finance.

Bohmfolk has estimated that one project out of every five selected is an optimistic average. Thus, his estimation is 20%. Probably Bohmfolk's data were based on a general average of many commercial laboratories. Our team average was based on 40 select laboratories of outstanding research performance, and it is only to be expected that their percentage would be somewhat higher.

Some of the reasons our team gave for failure of projects are: (a) improper preliminary evaluation; (b) unforeseen problems interrupting the time schedule; (c) changing economic factors while the project is under way; (d) lack of good personnel. The last three reasons also may be caused by improper evaluation.

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Don't Lift It Alone

Hazards of Heavy Lifting in the Grain and Grain Processing Industries

By Dr W. Schweisheimer

A MILL worker—let's call him Jim—was going to move a heavy sack of grain. He called a fellow-worker for assistance, but he was tied down with another job. Jim didn't feel there was time to wait for help, so he lifted the sack by himself to "get it over with." He felt a sudden pain in the groin on his right side. The pain did not disappear.

The next day Jim saw his doctor, who found a hernia on his right side. It was probably caused or at least aggravated by the heavy lifting of the day before.

Lifting heavy loads is part of the routine job for mill workers and grain handlers. Excessive strain is placed on back, shoulders, abdominal (belly) muscles, and the heart muscle. Proper precautions should be taken either by providing mechanical lifting appliances where practicable, or if lifting operations are done by hand, providing suitable aids in order to reduce vertical lift as much as possible.

How It Affects The Heart

A healthy heart, well trained by long practice, will not revolt against extra-strain imposed by heavy lifting. In some activities in the milling and grain industries, men cannot avoid lifting heavy sacks of grain, etc. Every workman in these industries may have to strain himself by lifting heavy loads.

Your heart may do a good job for average work, but it may suffer under exaggerated strain. The heart is a muscle, it may get tired by overstrain just as arm muscles or leg muscles get tired. Experts state that men should not lift loads more than 130 lb. in weight, and women not more than 65 lb. for intermittent work and 50 lb. for continuous work. Raising a load from the feet is particularly difficult.

Repeated overstrain may enlarge the heart muscle. We call such enlargement "athlete's heart." Excessive exertion causes signs of breathlessness, palpitation of the heart, giddiness, fatigue. Pain in the heart region may result. Those are the normal answers of the body to physical strain. Healthy workers require considerable exertion before they have a feeling of distress. Weaker men require less exertion.

Best advice is to avoid overexertion and call a fellow-worker for assistance when lifting heavy loads. A mill worker who feels that he has overstrained himself, better put in a few days of rest. That is the best way to bring the heart back to normal.

A mill worker overstretched his right arm while he was carrying a heavy load, probably in connection with a brisk movement.

The next day he felt a dull pain in his right shoulder. An important nerve had been under pressure. He could not move his arm in the normal way. Despite treatment, the condition did not improve for quite some time. The nerve fibres are wrapped in a good layer of fat or connecting tissues. In some places they are more superficial, and strong pressure may hurt the fibres. Traction on the arm, a fall on the shoulder, or pressure on the shoulder from above by a heavy load may affect such nerves.

The arm muscles then feel weak; they lose strength. Arm or hand may become paralyzed. A nerve going to the muscles of the shoulder is the long thoracical nerve. When it is injured by excessive strain after carrying a heavy sack, recovery may need time. Proper treatment and avoiding heavy loads will restore the normal function of the nerve.

A Cause of Backache

The onset of acute backache (lumbago) may be dramatic in its suddenness. A mill worker lifts a heavy load which puts strain on the muscles of his back. Some muscle fibers are ruptured. He is struck with agonizing pain in the small of the back.

He cannot move, has to lie down. Later the pain eases; he can get up again. Other cases are not so fortunate; they cannot move by themselves. Particularly while working in stooped or twisted position, a sudden movement may injure the back muscles.

Though lumbago is very acute and disabling, return to normalcy may be quick. There is every reason not to repeat the heavy exertion for a long time since there is danger of recurrence.

Knock-knees are less common, today, due primarily to the use of mechanical devices. Many jobs in the milling and grain industries are performed more satisfactorily by mechanical aids. Where this is not possible, the best means of lifting the loads by hand have to be decided upon, taking into account whether construction of platforms, racks, benches, etc. will reduce the amount of vertical lift required.

Continuous standing at hard work and lifting heavy loads may produce weak foot and flatfoot. A worker who must stand the whole day and

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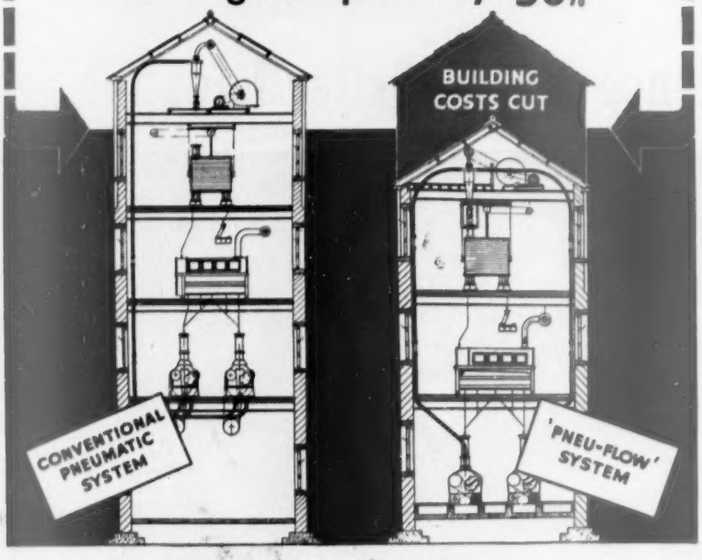

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lift and carry heavy loads may suffer from pain in foot and back, cramps in the calves and burning sensations in the soles of his feet.

The feet carry the weight of the body. Additional overweight in lifting loads presses the arches down. After repeated strain they stay down: flat feet have developed. Arch supports may bring relief. Many working people have good results with them. There are factory-made arch supports of different size and shape, and there are individually constructed arch supports.

It is also advisable to provide non-slip material for the floors in the areas where lifting operations are carried out.

Workers are more prone to accidents and injuries due to muscular strain when they are indisposed. Lighter work should be provided for these occasions. The employer who studies the hazards peculiar to his mill where lifting operations are undertaken, can take necessary steps to prevent this common cause of injury.

A hernia or rupture is a protrusion of a loop of intestine through a weak spot on the muscle wall of the abdomen. This loop cannot be seen; it is covered with skin and fat. All that could be seen in the worker whose injury we have described, was a small lump under the skin. Normally the belly muscles are one firm wall. But sometimes there are small gaps between the muscle fibers. Here the content of the belly may press forward in the groin or just below the groin on the thigh.

A violent exertion, sudden strain, lifting or pushing a heavy load may enlarge the gap and cause a hernia. Trusses are not always sufficient to keep the hernia back. An operation may be necessary to restore full working capacity to a man suffering from a hernia.

What Can You Do?

Get help whenever you have to lift or push or carry a heavy load. Don't mind the time and trouble getting the help.

If you have to lift or carry a heavy load, carry it close to the body. Keep the back as straight as possible. Place the feet close to the base of the object to be lifted.

This is important because it prevents the back muscles from taking all the load. Lift with the leg muscles and arm muscles. Bend the knees outward and "straddle" the load somewhat, keeping the back as straight as possible.

If you have to change your direction when in the upright position, be careful not to twist the body. Turn your body with changes of foot position.

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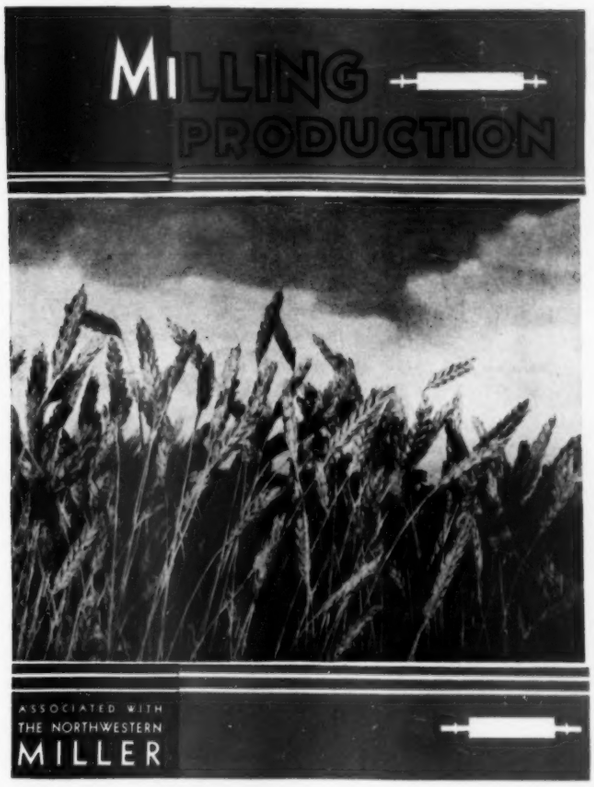

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